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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/577,936	06/05/2006	Shuichi Kohayashi	127912	9479

25944 7590 12/16/2008

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EXAMINER	
JACKSON, MONIQUE R	

ART UNIT	PAPER NUMBER
1794	

MAIL DATE	DELIVERY MODE
12/16/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/577,936	KOHAYASHI ET AL.	
	Examiner	Art Unit	
	Monique R. Jackson	1794	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *08 September 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-16* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *5/22/06, 8/1/08*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Election/Restrictions

1. Upon reconsideration of the restriction requirement and in view of Applicant's arguments filed 9/8/08, the Examiner has withdrawn the restriction requirement. The claims are hereby rejoined.

Claim Objections

2. Claims 4, 11, 12 are objected to because of the following informalities: the term "form" in lines 2, 7, and 4, respectively, should be "from". Appropriate correction is required.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1-16 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claims 1 and 8 recite the limitations with regards to the linear expansion coefficients of the metal layer and the plastic film however the claims fail to recite a temperature range for the difference in the linear expansion coefficients. Given that linear expansion coefficients vary with temperature, a recitation of a linear expansion coefficient or difference in coefficients without reciting the temperature for which the recited values or difference apply, renders the claims indefinite.

5. Claim 2 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 2 recites the limitation "a glass transition temperature of the thermoplastic

contained in the thermoplastic film layer is 180° or more" but fails to recite the temperature scale of the 180°.

6. Claim 8 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 8 recites the limitation, "selecting a plastic film layer as a base body having a difference between linear expansion coefficients of 15 x 10^{-6}/°K or less of the laminated plastic film and the metal layer in the laminated plastic film," however it is unclear whether the difference in the linear expansion coefficients is with respect to the laminated plastic film and the metal layer as the claim appears to recite, or the base body and the metal layer as was recited in Claim 1.

7. Claim 15 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 15 recites the limitation, "after the metal layer is formed by the vapor deposition method, or after the plating film forming step, by etching the metal layer, a predetermined circuit pattern is formed on the metal layer" in lines 2-4.

Claim Rejections - 35 USC § 102

8. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an

international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claim Rejections - 35 USC § 102

9. Claims 1-5, 7-9, and 13-15 are rejected under 35 U.S.C. 102(b) or (e) as being anticipated by Katsuki et al (USPN 6,824,827, also printed as US20020177000A1 and JP2002-293965.) Katsuki et al teach a method of making a polyimide laminate having a thin metal layer, preferably copper, formed on one or both surfaces of a polyimide film comprising a two- or three-layer film having a thermoplastic polyimide layer on one or both surfaces of a highly heat resistant polyimide base layer; wherein the thermoplastic layer has a Tg of 200° to 300°C, and the highly heat resistant polyimide base layer has a linear expansion coefficient of $5x10^{-6}$ to $25x10^{-6}$/°C (*reads upon claimed difference in expansion coefficients*; Col. 3-Col. 4; Col. 5, lines 20-65.) Katsuki et al teach that the polyimide laminate is subjected to a surface treating method and that the treated polyimide film has improved adhesion to metal formed by vapor deposition or a combination of vapor deposition and electroless plating and/or electroplating, wherein the metal layer comprises a first metal layer formed by vapor deposition such as sputtering, a second metal layer formed by vapor deposition and/or plating, and an outer metal layer formed by plating, wherein the first metal layer such as titanium can provide good adhesion between the polyimide film and the second metal layer (Col. 6-7.) Katsuki et al teach that the polyimide laminate is subjected to a heating treatment at a temperature above the Tg of the thermoplastic polyimide and below a temperature causing deterioration of the thermoplastic polyimide, and that prior to depositing the metal layers, the polyimide laminate is preheated to a temperature of 30° to 280°C (Col. 5, lines 37-48; Col. 7, lines 34-42.) Katsuki et al also teach that the thin

metal layer can be subjected to an etching step and may be utilized as a substrate in making FPCs, TAB tape carriers, multilayer FPCs, and rigid-flex circuit boards (Col. 7-8.)

10. Claims 1-3, 5-9, and 13-16 are rejected under 35 U.S.C. 102(a) as being anticipated by Tanaka et al (US 20060115670 A1, also printed as WO2004055110.) Tanaka et al teach a laminate comprising a two-layer or three-layer structure including a non-thermoplastic polyimide base film and a thermoplastic polyimide layer provided on one or both surfaces thereof, wherein the surface of the thermoplastic polyimide layer(s) is surface-treated to improve adhesion to subsequently applied metal layer(s) (Abstract.) Tanaka et al teach that the laminate can provide a printed circuit board with excellent adhesiveness, on which a micro-wiring circuit can be formed (Abstract.) Tanaka et al teach that the thermoplastic resin of the thermoplastic layer has a Tg of preferably 350°C or less, most preferably 280°C, and preferably more than 150°C (Paragraph 0110) Tanaka et al teach that the polymer base film has a coefficient of linear expansion of 2.0 $x10^{-5}$/°C or less, more preferably $1.5x10^{-5}$/°C or less, and most preferably 1x10-5/°C or less; and a tensile modulus of 5 GPa or more (which would be meet the limitation of being less than $15x10^{-6}$ different than the metal or copper; Paragraph 0119-0122.) Tanaka et al teach that a metal layer serving as a conductor layer can be formed by a wet plating method such as electroless plating or a dry plating method such as sputtering or vapor deposition (Paragraph 0156.) Tanaka et al teach that a circuit can be provided utilizing a resist layer or partially etching the metal layer as instantly claimed (Paragraph 0158, 0162-0163.)

11. Applicant cannot rely upon the foreign priority papers to overcome this rejection because a translation of said papers has not been made of record in accordance with 37 CFR 1.55. See MPEP § 201.15.

Claim Rejections - 35 USC § 103

12. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

13. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Summers et al (USPN 6,956,098.) Summers et al teach a metal/polyimide laminate comprising a vapor deposited metal layer on one or both sides of a polyimide base film having a linear expansion coefficient matched to the metal and a modulus from 800-1200kpsi, wherein a thermoplastic polyimide adhesive layer may be incorporated between the metal layer and the polyimide base film by applying the adhesive to the polyimide base film and drying, thereby improving adhesion between the base film and the metal (Col. 6, line 53-Col. 7, line 20; Col. 12, line 55-Col. 14; Col. 15, line 8-26; Examples.) Summers et al also teach that a coupling agent can be used as a pretreatment of the polyimide film, wherein the coupling agent can be coated on the film surface as a solution and may include a silane-based, titanium-based, or aluminum-based coupling agent, to improve adhesion between the base film and the metal (Col. 14, line 9-31.) Summers et al also teach that the adhesion between the polyimide film and the metal can be increased by subjecting the polyimide film to heat treatment step from 200°C to 600°C (Col. 13.) Summers et al teach that a circuit pattern can be formed on the metal/polyimide laminate broadly by application of a resist, photo-patterning and development of the resist, copper etching and removal of the resist as instantly claimed (Col. 12, lines 55-67.) Summers et al do not specifically teach that the laminate is produced by incorporating the thermoplastic layers, the

coupling agents, and the heat treatment step, however, given that Summers et al teach that all three provide improved adhesion between the polyimide base and the deposited metal, one having ordinary skill in the art at the time of the invention would have been motivated to incorporate intermediate thermoplastic layers and subjecting the polyimide base with the thermoplastic polyimide layers to subsequent adhesion enhancement steps taught by Summers et al including applying the coupling agents to the thermoplastic layers and heat treating the resulting laminate prior to depositing the metal, given the reasonable expectation of success. With respect to Claim 2, though Summers et al do not specifically teach the Tg of the thermoplastic adhesive layer, it would have been obvious to one having ordinary skill in the art at the time of the invention to utilize a thermoplastic polyimide having a Tg equal to or lower than the Tg of the base film, specifically around 300°C.

14. Claims 1-5 and 7-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hara et al (US 2001/0030122 A1.) Hara et al teach a laminate comprising thermoplastic polyimide layers applied to one or both sides of a non-thermoplastic polyimide base film and then dried, followed by sputtering a conductor or copper layer on the thermoplastic surface layer(s) subjected to heat treatment step, followed by a wet plating method such as electroplating to obtain the desired conductor layer thickness (Entire document, Abstract; Paragraphs 0016-0030; 0041.) Hara et al teach that the heating temperature is preferably 30°C or higher than the glass transition temperature of the thermoplastic polyimide, wherein when a polyimide having a glass transition temperature of 150°C, for example is utilized, the heating temperature preferably ranges from 150° to 280°C (Paragraph 41-42.) Hara et al also teach that adhesion between the thermoplastic polyimide layer and the metal can be improved by various surface treatments

including surface roughening treatment as well as introducing a functional group to further enhance the adhesion strength (Paragraph 044.) Hara et al further teach examples wherein a thermoplastic resin having a glass transition temperature of 190°C is utilized (Examples.) Hara et al do not specifically teach the linear expansion coefficient of the non-thermoplastic base film with respect to the conductor or copper layer, however, it is well established in the art that matching of the CLE or CTE of the polyimide base film to the copper or conductor layer provides improved mechanical properties in the art, including reduced curling, and hence one having ordinary skill in the art at the time of the invention would have been motivated to minimize the difference between the polyimide base film and the conductor layer. With respect to the enhance adhesion surface treatments, Hara et al do not specifically teach applying a Si, Ti or Al compound in order to introduce the desired functional groups, however, organic silane coupling agents, titanate coupling agents and aluminum coupling agents are all obvious surface treatment agents for improving adhesion between a polyimide resin and metal and would have been obvious to one having ordinary skill in the art at the time of the invention.

15. Claims 1-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Watanabe et al (USPN 4,937,133.) Watanabe et al teaches a double-sided metal/polyimide laminate for use in producing flexible printed circuit boards, comprising a core of low thermal expansion polyimide having a coefficient of linear expansion of (0-19)x10^{-6}/°K, outer layers of high thermal expansion, thermoplastic polyimide with a Tg of 350°C or less and a coefficient of linear expansion of preferably 5x10^{-6}/°K or more on the core, and a conductor layer, preferably copper on both outer surfaces, wherein the laminate can be formed by sequentially or simultaneously applying precursors solutions for the polyimide layers to the metal which may be treated with

aluminum alcoholates or chelates or silane coupling agents, and then subjecting the laminate to heat treatment at a temperature of about 300°C to 400°C or lower than the decomposition temperature of the polyimides (Abstract; Col. 2-4; Col. 6-7, Examples.) Watanabe et al further teach that an additional high thermal expansion polyimide layer may be provided between the other side of the low thermal expansion core layer and the second copper layer (Col. 6) and that the laminate can be formed by a process as instantly claimed wherein the precursors solutions are sequentially or simultaneously applied to the first metal foil, then subjected to heat treatment, and heat pressing with a second metal foil or by adhering two coated metal foils resin to resin (Col. 7.) Hence, Watanabe et al suggests utilizing a core polyimide having a coefficient of linear expansion that would be within $15x10^{-6}$/°K of the conductor or copper layer, however Watanabe et al do not teach that the copper layers are formed by vapor deposition followed by a plating step as instantly claimed. However, it is well established in the art that direct deposition of the copper layer onto the polyimide film is a known alternative method for producing copper/polyimide laminates, wherein direct deposition is known to provide improved adhesion of the metal or copper to the polyimide film. Further, it is well established in the art that direct deposition of the copper can be provided by a dry and/or wet method including a first dry method such as sputtering followed by a wet method such as electroless plating, wherein the silane coupling agent or other coupling agents can be provided on the surface of the polyimide film to improve adhesion between the polyimide and the metal. Hence, it would have been obvious to one having ordinary skill in the art at the time of the invention to produce the double-sided laminate taught by Watanabe et al by sputtering and/or plating of the copper layers directly on a pre-formed polyimide laminate comprising the three-layer structure taught by Watanabe et

al, wherein the silane coupling agent taught by Watanabe et al is applied to the surface of the polyimide as opposed to the surface of the metal, and to further produce a desired circuit pattern using a resist film and etching as instantly claimed. With regards to Claim 6, though Watanabe et al do not specifically teach the elastic modulus of the polyimide film as instantly claimed, Watanabe et al do teach that the polyimide laminate is suitable for producing flexible PCBs and hence one having ordinary skill in the art at the time of the invention would have been motivated to utilize routine experimentation to determine the optimum polyimide and layer thickness to provide the desired elastic modulus for a particular end use wherein the claimed range is typical for PCB laminates.

16. Claims 6, 10-12 and 16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Katsuki et al. The teachings of Katsuki et al are discussed above. Though Katsuki et al do not specifically teach the claimed modulus, one having ordinary skill in the art at the time of the invention would have been motivated to utilize routine experimentation to determine the optimum polyimide and layer thickness to provide the desired elastic modulus for a particular end use wherein the claimed range is typical in the art. With regards to Claim 10, though Katsuki et al teach that the polyimide surface can be subjected to various surface treatments to improve adhesion to the metal layer, Katsuki et al do not specifically teach applying an organic coupling agent as instantly claimed, however, organic silane, titanate and aluminum coupling agents are well known and obvious adhesion promoting agents in the art and would have been obvious to one having ordinary skill in the art at the time of the invention. Lastly, though Katsuki et al teach that the laminate can be utilized to produce printed circuit boards and that the metal can be etched, Katsuki et al do not specifically teach utilizing a resist film however the use

of a resist film to provide the desired circuit pattern would have been obvious to one having ordinary skill in the art at the time of the invention.

17. Claims 4 and 10-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tanaka et al. The teachings of Tanaka et al are discussed above. Though Tanaka et al teach that the polyimide surface can be subjected to various surface treatments to improve adhesion to the metal layer, Tanaka et al do not specifically teach applying an organic coupling agent as instantly claimed, however, organic silane, titanate and aluminum coupling agents are well known and obvious adhesion promoting agents in the art and would have been obvious to one having ordinary skill in the art at the time of the invention.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Monique R. Jackson whose telephone number is 571-272-1508. The examiner can normally be reached on Mondays-Thursdays, 10:00AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rena Dye can be reached on 571-272-3186. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Monique R Jackson/
Primary Examiner, Art Unit 1794
December 15, 2008